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Computational formulation for the asymptotic response of elastoplastic solids under cyclic loads

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Abstract

We propose in this paper an algorithm to compute the stabilized solution for an elastoplastic solid under cyclic loadings in excess of the shakedown limits. The numerical procedure is based on a formulation of the set of asymptotic conditions, comprising a reduced number of unknowns and equations. The algorithm strongly relies on a special trial and projection operation proposed here for the local update of the plastic strain increments.

Keywords: Elastoplasticity, Cyclic Loads, Direct Methods, Shakedown

1. Introduction

The subject of the paper is the direct computation of the steady state produced in an elastoplastic body submitted to cyclic loadings exceeding the shakedown limits (Frederick and Armstrong, 1966; Gokhfeld and Cherniavsky, 1980; Polizzotto, 1994a,b; Ponter and Chen, 2001; Polizzotto, 2003; Peigney and Stolz, 2003).

The fact that many structures submitted to cyclic loadings attain a stabilized response is experimentally observed and theoretically proven for some general models of inelastic behavior. It was so recognized (Frederick and Armstrong, 1966; Polizzotto, 1994a,b) that the asymptotic stresses in such structures variate cyclically and with the same period as the applied loading. For loadings below the shakedown limit (Lubliner, 1990; Zouain, 2004), the

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